Schreiber Channel Provincial Nature Reserve

Management Plan Background Information

Ontario
Ministry of Natural Resources

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1.0 Introduction

Schreiber Channel Provincial Nature Reserve is located west of Schreiber, Ontario, encompassing a typically rugged landscape on the north shore of Lake Superior (Figure 1). Established in 1979 as a nature reserve, the most protective of Ontario's six park classes, it incorporates internationally recognized occurrences of Gunflint Formation algal chert notable for the microscopic life form remains they contain. The Lower Algal Chert submember of the Gunflint Formation of Middle Precambrian age, contains evidence of some of the oldest known life forms in the world. The nature reserve contributes to the protection objective of the Ontario parks system by incorporating the principal microfossil sites in situ (in place). The park also incorporates a provincially significant exposure of the lowest member of the Gunflint Formation, the Kakabeka Conglomerate, and an excellent example of the approximately 500 million year erosional interval between the Early and Middle Precambrian in the form of the unconformable metavolcanic-conglomerate contact.

2.0 Regional Setting

2.1 Location

Schreiber Channel Provincial Nature Reserve is located in Killraine Township on the north shore of Lake Superior, 6 km (3.7 mi.) west-southwest of Schreiber, Ontario (Figure 1). The mainland area of 12.173 ha (30.079 acres) is defined by a rectilinear boundary based on a parcel of land originally withdrawn under The Mining Act (Order No. W.13/75; Section 43; Chapter 274; R.S.O. 1970). Flint Island (formerly Island J.D. 2100) is also included in the nature reserve, covering 0.736 ha (1.819 acres). The total land area of the nature reserve is 12.909 ha (31.898 acres) (Figure 2).

2.2 Legal Status

Schreiber Channel Provincial Nature Reserve was established in 1979 and is described in the Revised Regulations of Ontario, 1980 (Ontario Regulation 821/80, Appendix B, Schedule 123).

2.3 Land Use

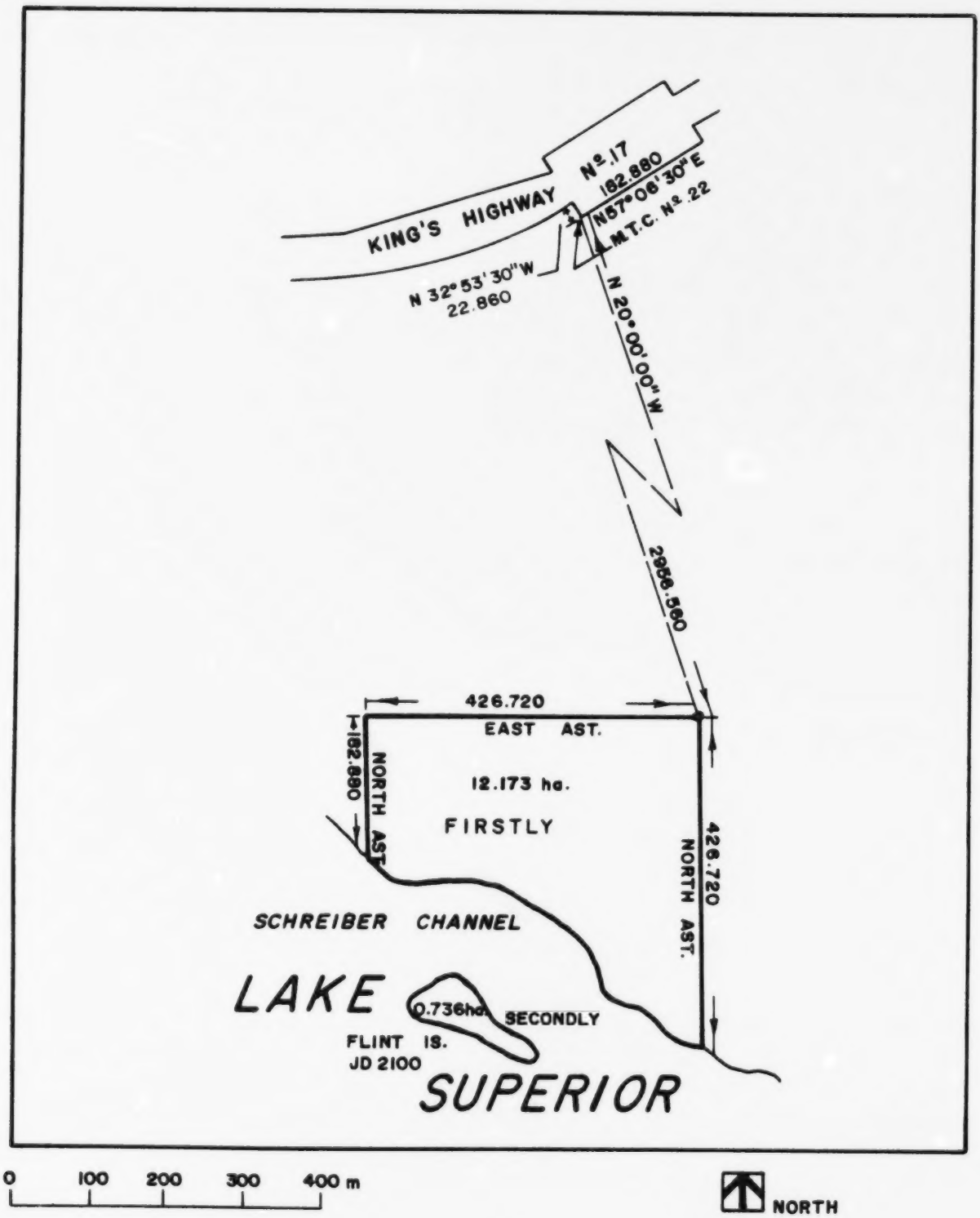
The difficult access, remoteness and the rugged nature of the Lake Superior shoreline in the vicinity of the park has limited such traditional activities as logging, mineral exploration, hunting, fishing and trapping. Under the nature reserve classification most of these activities have been and will continue to be strictly prohibited in the park.

Figure 1

Regional Setting

Figure 2

Boundary Map



All of the lands immediately adjacent to the nature reserve are crown lands. There is presently no mining or logging activity in the vicinity. Recent claim staking (1982) has occurred adjacent to the park boundaries, indicating an interest in the mineral potential of the area.

2.4 Access and Transportation Routes

The nature reserve lies on an isolated portion of the north shore of Schreiber Channel, Lake Superior (Figure 1). Highway 17 lies 3.3 km (2 mi.) to the north, and the C.P.R. mainline track comes in within 60 m (197 ft.) of the northeast park boundary.

Access to the nature reserve is best achieved from Lake Superior by boat. The nearest access points on Lake Superior are at Selim, 6.5 km (4 mi.) to the northwest, and Terrace Bay landing, 17 km (10.5 mi.) to the east-southeast. The site is essentially unprotected from Lake Superior's open waters and can therefore be an unpredictable and dangerous place to visit by boat.

The Voyageur Trail Association (Sault Ste. Marie, Ontario) has established, through local clubs, a hiking trail along much of the north shore of Lake Superior. The Casque-Isle Section of the North Shore Hiking Trail traverses the nature reserve along and near the shoreline. The trail consists of shrub clearance, tree blazing, painted markers on rocks, tree-mounted markers, and occasional flagging. The trail has not been heavily used to date.

3.0 Biophysical Resources

The following is a brief description of the major biophysical factors influencing the ecology of the nature reserve. The geology of the site will most affect the planning process for the nature reserve, but climate and vegetation are also factors to be considered.

3.1 Climate

The climatic conditions along the north shore of Lake Superior warrant mention because of their direct impact on the accessibility of the nature reserve. The information is drawn from McGregor's (1974) climatic summary of the Neys Provincial Park area.

The proximity of Lake Superior produces the relatively cool summer temperatures and mild winter temperatures of the area, as well as the highest summer precipitation (40.6 cm; 16 in.) in Ontario. On average, sixteen days of each summer month are marked by some rainfall, often accompanied by fog. The predominant wind direction along Lake Superior's north shore

in summer is from the south-southwest. Summer storms can come up quickly across the lake, producing high waves, rain and lightning with little advance warning. Although the nature reserve lies in part in the lee of the north shore islands and is protected by these islands from the full force of such storms, lake travel in Schreiber Channel can still be treacherous to the unprepared.

The difficult terrain and accumulation of shore ice in Schreiber Channel prevents ready access to the site in winter.

3.2 Topography and Soils

The nature reserve area lies on the rugged north shore of Lake Superior. A bedrock ridge in the northeast corner of the nature reserve represents the highest point in the park, at over 243 m (800 ft.) elevation, or 59.5 m (198 ft.) or more above the level of Lake Superior (183.5 m, 602 ft. ASL). The terrain rises to this high point in a series of moderately broken to locally highly broken steps. Steep bare bedrock slopes and low cliffs are not uncommon. The lower bedrock slopes are often covered by a thin discontinuous veneer of stony sand till or scree slopes of moderate to small boulders. Cobble and gravel beaches occupy low areas between bedrock promontories along the shoreline. Low, wide, vegetated raised cobble beaches can be traced inland behind the present day beaches.

3.3 Regional Geology

The north shore area around Schreiber Channel Provincial Nature Reserve is underlain by Early, Middle and Late Precambrian rocks.

A synclinally folded sequence of metavolcanic and metasedimentary rocks comprise the Early Precambrian. The metavolcanic rocks represent several mafic to felsic cycles and are interbedded with volumetrically subordinate metasedimentary rocks (Carter, 1981). Pillowed structures in the metavolcanics associated with primary structures in the metasediments are indicative of a subaqueous (underwater) environment of deposition. Regional metamorphism to the amphibolite facies is evident in the rocks. These rocks are widely intruded by granitic and syenitic bodies (Carter, 1981).

The base of the Middle Precambrian Gunflint Formation is exposed along the north shore of Lake Superior between Rossport and Schreiber, and on some of the offshore islands. It is composed of a variety of clastic (conglomerate and black shale) and chemical (chert and carbonate) sedimentary rocks which interfinger and form a complex basal member (Shegelski, 1980). The rocks dip southward at about ten degrees.

Late Precambrian diabase intrusions crosscut all rocks described above. The black diabase forms large dikes and sills as well as small local intrusions. The latest known intrusions in the area comprise small granitic dikes and stringers.

3.4 Park Geology

Schreiber Channel Provincial Nature Reseve is underlain by Early to Late Precambrian rocks (Figure 3). Outcrop exposure is generally good, especially on the upland knolls and along the shoreline of Lake Superior, where vegetation and soil cover is minor.

The oldest rocks in the nature reserve consist of Early Precambrian mafic to intermediate metavolcanics, ranging in colour from black to light green on weathered exposures. These rocks are interpreted to have originally formed in a subaqueous environment by the well-preserved pillow structures visible in some shoreline outcrops. The Kenoran Orogeny, a major geological upheaval which culminated about 2500 million years ago (Stockwell, 1982), was the last event to substantially alter the volcanic rocks, causing medium-grade metamorphism and distortion of the pillow structures.

Unconformably overlying the metavolcanic rocks are a sequence of Middle Precambrian sedimentary rocks known as the Gunflint Formation. It is exposed along the shoreline of the nature reserve and in section on Flint Island. The lowermost unit, the Kakabeka Conglomerate, accumulated as the result of the erosion of the Early Precambrian basement during an erosional period which may have lasted some 500 M.Y. (Pye, 1969). The nature reserve encompasses one of the most easterly outcroppings of this unit and one of the best examples of its occurrence. The conglomerate is composed predominantly of fragments of the underlying basement rock set in a matrix of chloritic and quartzitic sand.

A thin layer of chert is exposed sporadically in the wave zone on the Schreiber Channel shoreline near the eastern and western nature reserve boundaries and on the nearshore uplands. This Lower Algal Chert submember of the Gunflint Formation consists of laminated reef-like mounds of black, red and white stromatolitic chert (Kustra et al, 1977). This chert is of particular interest because it contains a variety of well-preserved stromatolitic laminae and microfossils (see following section: The Microfossils). The chert directly overlies the early Precambrian basement (as in the western exposure in the nature reserve) or coats the upper surface of the Kakabeka Conglomerate (well illustrated in the eastern exposure in the nature reserve) (Figure 4). The layering evident in the reef-like mounds in outcrop exposures consist of stromatolites, defined by Awramik et al (1976) as organic sedimentary structures produced by sediment trapping, binding and/or precipitation resulting from the growth of organisms,

Figure 3

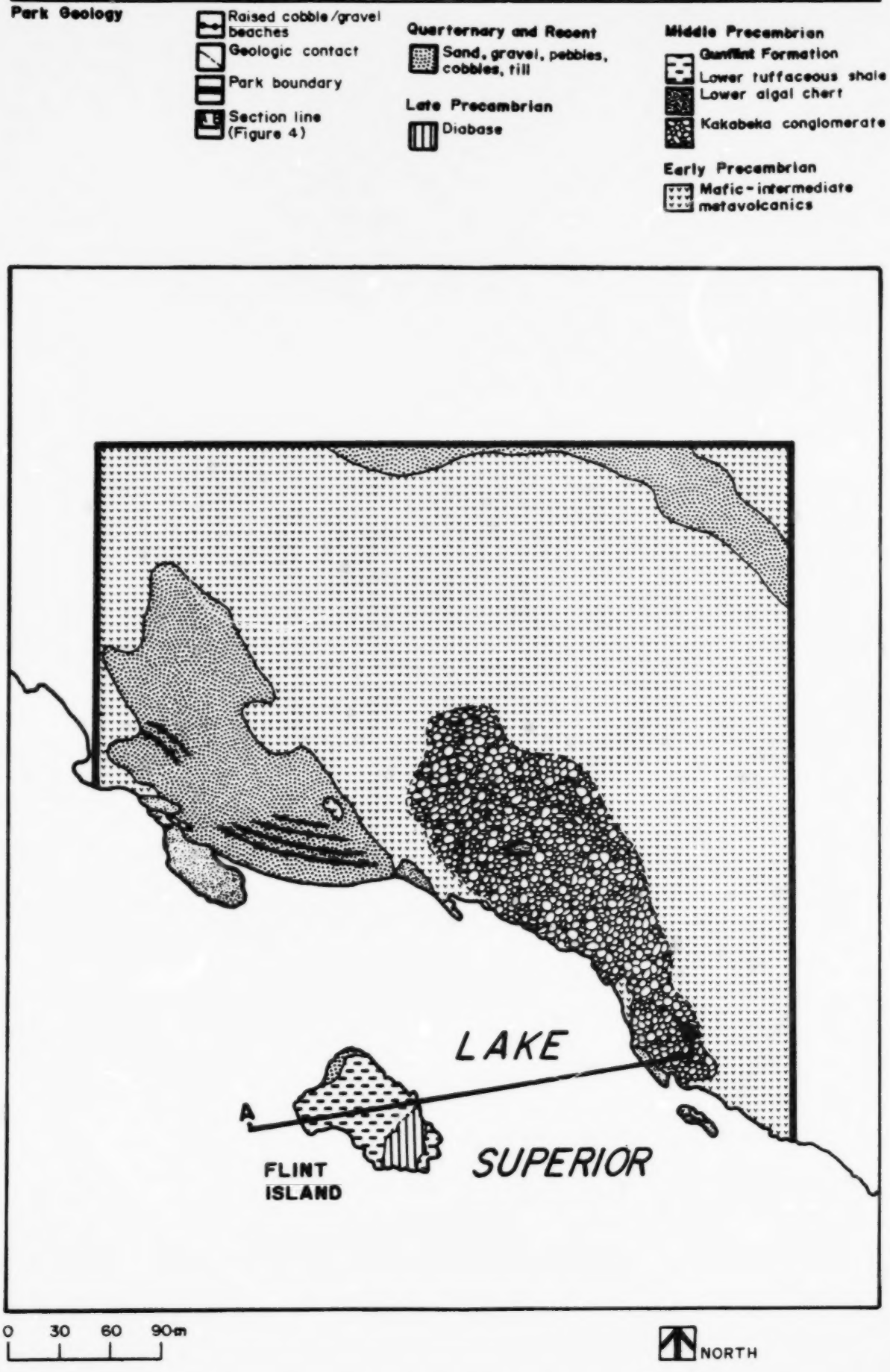

Park Geology
Raised cobble/gravel beaches
Geologic contact
Park boundary
Section line (Figure 4)
Quarternary and Recent
Sand, gravel, pebbles, cobbles, till
Late Precambrian
Diabase
Middle Precambrian
Gunflint Formation
Lower tuffaceous shale
Lower algal chert
Kakabeka conglomerate
Early Precambrian
Mafic-intermediate metavolcanics
LAKE
SUPERIOR
A
FLINT ISLAND
0 30 60 90m
NORTH

Figure 4

Geology: Cross Section

Late Precambrian

Diabase

Middle Precambrian

Gunflint Formation

Lower tuffaceous shale

Lower algal chert

Kakabeka conglomerate

Early Precambrian

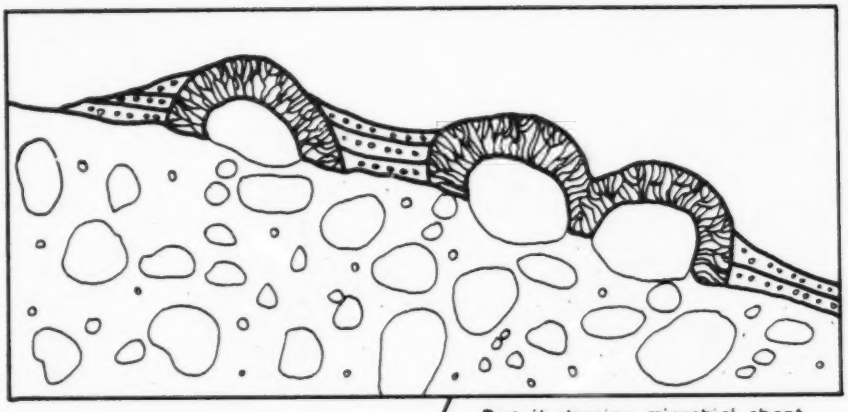
Mafic-intermediate metavolcanics

Inset Diagram

Cherty interlayers

Biohermal mounds

Conglomerate



Detail showing microbial chert veneer over conglomerate (After Hofmann, 1969).

LAKE SUPERIOR

FLINT ISLAND

B

A

View looking south along section line B-A (Figure 3).

Not to scale : vertical and horizontal Scales greatly exaggerated.

primarily blue-green algae. Within the layers of the stromatolites, microscopic unicellular and filamentous organisms can be found (Tyler and Barghoorn, 1954; Barghoorn and Tyler, 1965). The origin of the black chert is uncertain (Shegelski, 1980). Some scientists interpret the chert as a primary chemical deposit that precipitated out of the water entombing the microorganisms (Barghoorn and Tyler, 1965). Others interpret the original composition to have been carbonate that was subsequently replaced by silica (Markun and Randazzo, 1980).

The Lower Tuffaceous Shale member of the Gunflint Formation conformably overlies the Lower Algal Chert submember, although this contact is not visible in the nature reserve. Flint Island exposes a good section of the fissile black shale (Figure 4).

The Gunflint Formation is considered by most authors to have been deposited in a shallow marine environment at the margins of a restricted basin (eg. Markun and Randazzo, 1980; Shegelski, 1979; Awramik, 1976). The age of the Gunflint Formation has been variously assessed at somewhere between 1600 and 2500 M.Y., with an age of approximately 2000 M.Y. commonly suggested (Awramik, 1976). An excellent discussion of the genesis and age of the Gunflint Formation is presented by Knoll et al (1978).

Late Precambrian diabase dikes and sills intrude the older host rocks in the nature reserve. A sheared contact zone between the algal chert (Gunflint Formation) and a diabase dike is exposed at the western end of the main pebble beach. Diabase sills up to 2.5 m (8.2 ft.) thick have intruded the shales on Flint Island, forming the upper surface on part of the island (Figure 3). This relationship is well-exposed in section on the northeast side of the island. The diabase was intruded about 1000 M.Y. ago during a regional event possibly related to the development of the Lake Superior basin (Stockwell et al, 1976).

Small pegmatite and granitic dikes of Late Precambrian age crosscut all the rocks of the nature reserve. One such vein system has been eroded out of the host rocks on the western side of Flint Island, forming a considerable cut in the relatively smooth upper surface of shale.

The bedrock of Schreiber Channel Provincial Nature Reserve is mantled by a thin veneer of drift deposited during the retreat of the Laurentide ice mass about 9500 years B.P. (Before Present) (Saarnisto, 1974). A stony sand till survives at the bottom of rock knobs and in protected bedrock pockets. Pebble and cobble beaches occur at the present shoreline; similar wave conditions in the lowering levels of the glacial lake stages following ice retreat are reflected by at least three sets of raised beaches (up to the Sault Stage) behind the present beaches. Glacial erratics occur throughout both these deposits. Talus slopes flank the steepest bedrock knolls,

reflecting post-glacial freeze-and-thaw.

3.5 The Microfossils

Although the exposures of sedimentary rocks of the Gunflint Formation along the shore of Schreiber Channel have been reported in the literature since before the turn of the century, the significance of the thin layers of black chert near the base of the formation as preserves of Precambrian life forms was not realized until their discovery by Stanley Tyler in 1953 (Tyler and Barghoorn, 1954). Since then, the Schreiber Channel site has become the most thoroughly studied and documented occurrence of Precambrian microfossils in Canada (Hofmann, 1981), and possibly the world.

The cherts of the Lower Algal Chert submember of the Gunflint Formation contain well-preserved microbial laminae (stromatolites) and a diverse assemblage of the oldest confirmed life forms in Canada. The original composition of the chert is uncertain; it is not known whether the chert represents a primary deposit (Barghoorn and Tyler, 1965), or whether it is the product of silicification of limestone under highly reducing conditions (Markun and Randazzo, 1980). It is the presence of the silica, however, whether original or introduced, that preserved the morphology of the enclosed microorganisms for up to 2500 million years (Knoll et al, 1978). The microorganisms are represented by unicellular and filamentous forms which can be compared to modern blue-green algae (Awramik and Barghoorn, 1977). Others are morphologically unlike any known modern biota (Schopf, 1975). Two types of stromatolitic structures have been identified in the Gunflint chert: horizontal laminated sheets (microbial mats); and localized convex mounds (bioherms). Discussions of these forms are presented by Awramik (1976) and Awramik and Semikhatov (1979).

To date, at least 30 types of life forms have been identified from the microfossiliferous chert of the Gunflint Formation (Awramik and Barghoorn, 1977). They fall into eight main catagories (Cloud, 1965):

1. thin septate threads resembling filamentous bacteria and blue-green algae;

2. spiral threads, probably degradational remnants of 1.;

3. large septate threads resembling blue-green algae;

4. non-septate or obscurely septate threads, probably degradation products of catagories 1. and 3.;

5. radiate structures resembling micro-colonies;

6. patterned globular bodies resembling planktonic algae or fruiting structures related to catagory 1.;

7. smooth spheres, probably reproductive cells or individual bacteria; and

8. sub-spherical and rod-shaped bodies which may be individual bacteria.

Cloud (1965, p.32) concludes that "not only is the morphological similarity to living microorganisms so strong and so detailed as to make an evolutionary continuity almost certain, but, in addition, the septate thread, the cellular-walled spheroid, and the perforate spheroid have, to my knowledge, never been produced without biologic intervention."

The apparant population explosion of primitive oxygen-producing organisms near the Archean-Proterozoic boundary coincides with a postulated change in Earth's atmosphere from one with little or no free oxygen to one with significantly higher oxygen levels (up to 1% of present levels) (Cloud, 1974). Whether the atmosphere evolved as a result of nonbiotic reactions, and thereby spawned the conditions for the apparant rapid increase in the previously slow evolution of microorganic life, or whether the change in atmosphere was the direct result of the increase in oxygen-producing biota is not certain (Schopf, 1975). It is likely that a combination of the two conditions occurred; its effects were the meteoric increase and diversification of Precambrian life, and the advent of relatively abundant free oxygen in Earth's atmosphere. This set the stage for oxygen-dependant life forms to multiply and evolve throughout the rest of Earth history.

Detailed descriptions of the type and significance of the microfossil assemblages found in the Gunflint Formation can be found in the following references: Awramik (1976), Awramik and Barghoorn (1977), Awramik and Semikhatov (1979), Barghoorn (1971), Barghoorn and Tyler (1965), Cloud (1965), Edhorn (1973), Knoll et al (1978), and Markun and Randazzo (1980).

3.6 Flora and Fauna

Schreiber Channel Provincial Nature Reserve is located in Site District 5 of Hill's (1959) Site Region 3W. It also lies in the Superior Section of the Boreal Forest Region (Rowe, 1972). As such, the park is characterized by long, humid, cold winters and short warm-cool summers due to the influence of Lake Superior. The rugged shoreline of the lake is dominated by closed mixed ciniferous-deciduous forests with white birch (Betula papyrifera), trembling aspen (Populus tremuloides), balsam fir (Abies balsamea) and white spruce (Picea glauca) as the major constituents. Within the park boundaries this forest type dominates; however, there are two other generalized communities present. One occurs as open forest on bedrock outcrop and includes small areas of sparsely vegetated unforested rock; the second is the shoreline habitat which

has two major subdivisions - the rugged bedrock shore in the eastern portion of the park, and the cobble beach in the western portion of the park, both subdivisions are sparsely vegetated. A biological survey has not been conducted in the park, but a brief list of vascular plants and bird species observed on field visits to the site is presented in Appendix A.

The presence of butterwort (Pinguicula vulgaris), an Arctic-alpine species, suggests that other disjunct species with similar geographic affinities may be present. Given and Soper (1981) describe in some detail the shoreline habitats and associated species to be linked with the Arctic-alpine element along the Lake Superior shore.

Due to the small size of the park, its contribution to habitat protection for large fauna species (eg. moose) and the protection of complete ecosystems is minimal. However, the nesting colony of herring gulls (Larus argentatus) on Flint Island is noteworthy. In 1982, there were 96 nests with either eggs or young. Other fauna either present or expected from reference works (Godfrey, 1966; Peterson, 1966) are typical of the low coastal location.

4.0 Cultural Resources

A brief survey of Schreiber Channel Provincial Nature Reserve has uncovered no cultural features.

Evidence of the activities by historic man is found near the nature reserve along the north shore of Lake Superior and on the offshore islands. West of the nature reserve, near Selim Landing, a Northwest Company post was reported by Bell (1870). Its remains have yet to be found. Clay pipes found on Wilson Island are evidence of early trade activity or encampment by voyageurs. Evidence of small, now abandoned mining operations, such as sluice troughs, crumbling foundations, and building remains, also dot the north shore. Other historic remains have been recorded near Rossport and in Collingwood Bay. Several shipwrecks lie in Schreiber Channel, most notably the Gunilda, sunk in the early 1900's, and the Rappahonock, sunk in the 1880's.

Prehistoric native activities have been recorded throughout the region. Of note are pictographs on Worthington Bay, pukaskwa pits and Late Woodland ceramic remains on Cobinosh Island, and Laurel and Black Duck remains near Rossport.

5.0 Issues

The major issues which are to be addressed in the management plan of Schreiber Channel Provincial Nature Reserve involve the following:

1. the profile of the park in the Provincial Parks system;

2. the need to control research at the site and to redirect sampling pressures away from the site;

3. the need to delineate the park boundary.

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Appendix A

Flora and Fauna Observed at Schreiber Channel Provincial Nature Reserve

VASCULAR PLANTS (listed alphabetically by Latin binomal)

Abies balsamea - balsam fir
Achillea millefolium - yarrow
Alnus rugosa - speckled alder
Arabis lyrata - lyre-leaved rock cress
Arctostaphylos uva-ursi - bearberry
Betula papyrifera - white birch
Clematis verticillaris - purple clematis
Corydalis sempervirens - pale corydalis
Juniperus communis - common juniper
Juniperus horizontalis - creeping juniper
Linnaea borealis - twinflower
Lonicera diervilla - bush honeysuckle
Maianthemum canadense - Canada mayflower
Matricaria matricariodes - pineappleweed
Picea glauca - white spruce
Picea mariana - black spruce
Pinguicula vulgaris - butterwort
Populus tremuloides - trembling aspen
Potentilla fruticosa - shrubby cinquefoil
Potentilla palustris - marsh cinquefoil
Potentilla tridentata - three-toothed cinquefoil
Rubus idaeus - red raspberry
Salix sp. - willow
Pyrus decora - mountain ash
Thlaspi arvense - field penny-cress
Thuja occidentalis - eastern white cedar

total: 26 species

BIRDS (listed alphabetically by Latin binomals)

Actitis macularia - spotted sandpiper
Bombycilla cedrorum - cedar waxwing
Catharus fuscescens - veery (nesting)
Larus argentatus - herring gull (nesting)
Parus atricapillus - black-capped chickadee
Zonotrichia albicollis - white-throated sparrow

also noted: Lycaena ladon - spring azure butterfly